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BOSTON SOCIETY OF CIVIL ENGINEERS
FOUNDED 1848

PROCEEDINGS

PAPERS IN THIS NUMBER.

"An Engineer's Impressions of Japan." Dana M. Wood.
Memoir of Deceased Member.

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Contributors are hereby notified that proof will not be submitted to them for examination unless requested before the 10th of the month preceding the month of publication.

MINUTES OF MEETINGS.

Boston, September 15, 1920. — A regular meeting of the Boston Society of Civil Engineers was held this evening at Chipman Hall, Tremont Temple, and was called to order at 7.50 o'clock by the President, Frank A. Barbour.

There were 110 members and visitors present, including many ladies.

The record of the May meeting was read and approved.

The Secretary reported for the Board of Government that at its meeting held on July 2, 1920, it had elected the following candidates to membership in the grades named:

Members: Messrs. Walter I. Brown, George L. Bryant, Willard G. Burleigh, Herbert S. Cleverdon, James S. Crandall, Ralph U. Cross, Walter C. Eberhard, Howard L. Foster, George P. Morrill, Thomas F. McSweeney, Martin J. O'Brien, Francis

P. Scully, Edward W. Shaw, William J. Theriault and Carl W. Wood.

Juniors: Messrs. Oliver B. Brown, William A. Clark and Harold S. Cole.

Associate: Mr. Harold L. Kinsman.

He further reported the election by the Board, this afternoon, of the following additional candidates in the grades named:

Members: Messrs. Herbert B. Allen, Karl R. Kennison and William D. Henderson.

Junior: Mr. Earle H. Cove.

Mr. Whitney moved that the vote passed at the May meeting, receiving the report of the Committee on Compensation of Engineers and sending out its recommendations to a letter ballot, be reconsidered, and it was voted unanimously to reconsider this vote. Mr. Whitney then moved, as a substitute, the following vote:

That the report be received and the committee discharged, and that the question involved in the report be submitted to the members of the Society in the form of a questionnaire.

The motion was adopted by a unanimous vote.

The Secretary presented a memoir of Past President Henry Manley, prepared by a committee consisting of C. F. Allen, E. W. Howe and L. B. Manley.

He also presented a memoir of Robert Winthrop Pratt, prepared by a committee consisting of G. W. Fuller and Morris Knowles. Both memoirs were received and ordered printed in the JOURNAL of the Society. The President announced the deaths of two members of the Society, — John R. Burke, who died April 27, 1920, and William M. Brown, who died May 29, 1920.

By vote the President was requested to appoint committees to prepare memoirs.

He has appointed the following to membership on these committees: On memoir of John Ryan Burke, Mr. Frank W. Hodgdon, and on memoir of William M. Brown, Messrs. Howard A. Carson and Henry T. Stiff.

The speaker of the evening, Mr. Dana M. Wood, was then presented, and there followed a most interesting talk on "An

Engineer's Impressions of Japan," which was illustrated with a large number of beautifully colored slides.

Adjourned.

S. E. TINKHAM, *Secretary*.

ANNUAL FIELD DAY.

THE regular meeting of the Society for June was dispensed with this year, and in its place the members joined with the members of the New England Water Works Association in the annual field day, which was held on June 9, at Wardhurst, on Lake Suntaug, Lynnfield, Mass.

Before the dinner, athletic sports were held, and after the dinner prizes were awarded to the winner in each event. In the afternoon a baseball game was played, the Boston Society team winning the game.

The day was perfect, and each of the 109 present pronounced it the best joint field day the organizations had ever held.

S. E. TINKHAM, *Secretary*.

APPLICATIONS FOR MEMBERSHIP.

[September 15, 1920.]

THE By-Laws provide that the Board of Government shall consider applications for membership with reference to the eligibility of each candidate for admission and shall determine the proper grade of membership to which he is entitled.

The Board must depend largely upon the members of the Society for the information which will enable it to arrive at a just conclusion. Every member is therefore urged to communicate promptly any facts in relation to the personal character or professional reputation and experience of the candidates which will assist the Board in its consideration. Communications relating to applicants are considered by the Board as strictly confidential.

The fact that applicants give the names of certain members as reference does not necessarily mean that such members endorse the candidate.

The Board of Government will not consider applications until the expiration of twenty (20) days from the date given.

LUCAS, JOHN, Lynn, Mass. (Age 21, b. Bury, England.) Educated in public schools of Lawrence, Lynn High School and Mass. Institute of Technology; instructor in topographical engineering for Mass. Institute of Technology at East Machias. At present assistant civil engineer with Jackson & Moreland, Boston, Mass. Refers to J. B. Babcock, C. B. Breed, E. H. Cameron, J. W. Howard, A. G. Robbins and C. M. Spofford.

McCANN, FRANK J., Lowell, Mass. (Age 24, b. Lowell, Mass.) Graduate of Wentworth Institute in architectural construction. From June, 1916, to December, 1917, employed by construction companies in Lowell, as a draftsman, surveyor and assistant to superintendent; December, 1917, to April, 1919, in the U. S. Army; April to December, 1919, with Massachusetts Engineering Co. and Kearns Construction Co., as an architectural designer and draftsman; and December, 1919, to date with General Electric Co. as an architectural designer, draftsman and inspector of buildings. Refers to S. R. Berke, F. G. Berry, W. D. Morrill and H. C. Thomas.

SUTHERLAND, CLARENCE HALE, Cambridge, Mass. (Age 36, b. Foxcroft, Me.) Graduate Harvard College, A.B., 1916; Mass. Institute of Technology, S.B., 1911; rodman, P. C. C. & St. L. Ry., summer 1909; draftsman, Manitoba Bridge and Iron Works, summer 1910; draftsman, Phoenix Bridge Co., summer 1911; draftsman and designer, Corrugated Bar Co., Buffalo, N. Y., 1912-1913; instructor, Mass. Institute of Technology, 1913-17; summer work, 1913-17, on reinforced concrete design, Corrugated Bar Co., Stone & Webster, Fred T. Ley Co.; 1st Lieut., U. S. A., 1917-19; asst. professor of structural engineering, Mass. Institute of Technology, 1919 to date. Refers to C. R. Berry, B. A. Bowman, H. B. Luther, W. F. Pike, W. D. Trask and E. L. Walker.

EMPLOYMENT BUREAU.

THE Board of Government maintains an employment bureau for the Society, to be a medium for securing positions for its members and applicants for membership, and also for furnishing employees to members and others desiring men capable of filling responsible positions.

At the Society room two lists are kept on file, one of *positions available* and the other of men *available*, giving in each case detailed information in relation thereto.

MEN AVAILABLE.

No. 505. Age 27. High school graduate. Has had seven years' varied experience on surveying, drafting, chief of party and inspecting. Desires position as draftsman, transitman or chief of party.

No. 507. Age 34. Three years' study of architecture and design at Lawrence Scientific School; graduate of Lowell Institute School for Industrial Foremen, buildings course; five years in architect's office; three years checking in architectural squad of large engineering firm; one year architectural and structural drafting and designing. Desires position on structural, architectural, drafting or designing work.

No. 508. Age 23. Three and a half years high school; now attending Northeastern evening school. One year high school engineering and field work; one half year practical work. Desires position as chainman or rodman.

No. 509. Age 32. Fourteen years' varied engineering experience on roads, street pavements, sewers, water works, bridges and buildings. Acted as superintendent in charge of concrete bridge structure. Can do some concrete designing. Desires position with some contracting firm, where advancement is possible.

LIST OF MEMBERS.

ADDITIONS.

BADGER, A. W.....	87 West St., Hyde Park, Mass.
HASKELL, G. F.....	703 City Hall Annex, Boston 9, Mass.
O'BRIEN, M. J.....	7 Taylor St., Medford, Mass.
SCULLY, F. P.....	88 Walnut Ave., Cambridge, Mass.

CHANGES OF ADDRESS.

ALLEN, R. C.....	9 Vine St., Manchester, Mass.
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FREEMAN, E. A.....	Y. M. C. A., Springfield, Mass.
LARNED, E. S.....	149 Highland Ave., Winchester, Mass.
LEAVITT, A. J.....	119 Blake St., Mattapan, Mass.
LEWIS, G. W.....	34 Banks St., Waltham, Mass.
LOUD, R. W.....	67 Everett St., Arlington, Mass.
MORRILL, W. D.....	48 Prospect St., Reading, Mass.
MORTENSON, E. D.....	18a Rockville Park, Roxbury, Mass.
MOULTON, J. W.....	Care University of Porto Rico, Rio Piedras, P. R.
SHAW, A. L.....	14 Beacon St., Boston 9, Mass.
SNOW, W. B.....	60 High St., Boston 9, Mass.
STROUT, H. E.....	San Mateo, Calif.
SULLIVAN, W. F.,	

Supt. and Mgr., Pennichuck Water Works, Box 425, Nashua, N. H.

TAYLOR, P. W.....	Riverdale Rd., Wellesley Farms, Mass.
TREADWELL, E. D.....	P. O. Box 246, Atascadero, Calif.
TURNER, D. L.....	Hotel Touraine, 9 East 39th St., New York, N. Y.
WARING, C. T.....	32 Giddens Bldg., Tampa, Fla.
WARREN, H. E.....	37 Temple St., Boston, Mass.

LIBRARY NOTES.

BOOK REVIEW.

"ENGINEERING FOR LAND DRAINAGE": By Charles Gleason Elliott, C.E., member American Society Civil Engineers. 3d edition, New York, John Wiley & Sons, Inc. Cloth, 5 x 7½ ins.; pp. 363. Illustrated.

REVIEWED BY C. H. PIERCE.*

In this little book of 353 pages Mr. Elliott has prepared what he terms "A Manual for the Reclamation of Lands Injured by Water." This is the third edition and has been entirely rewritten since its first publication in 1902. At the time of the second edition, in 1911, Mr. Elliott stated that he sought to cover the essential features of drainage engineering as practiced in this country at that time, including descriptions of the latest developments along each line, and to make the book adapted to the use of the professional engineer and the student. In the latest edition the author has revised some parts and added to others, and has introduced some new tables which he believes correspond to results obtained in practice. Credit has been given Trautwine's Engineers' Pocket-Book, the files of the U. S. Department of Agriculture, and other sources from which diagrams or data have been obtained.

The first twenty pages consist of historical matter under the heading "Development of Land Drainage," with descriptions of methods employed in draining the English Fens and Haarlem Lake, Holland. These are of interest, but it is doubtful if the statistics and cost data for those works would be of much value in planning drainage projects in any part of this country at the present time. Various topics, such as "Drain-Tile in the United States," "Drainage in the South," and "State Drainage Laws," are passed over with brief paragraphs.

The author's discussion of "The Drainage Engineer," in Chapter II, might be read with profit by every young engineer: "He should honor his profession by exhibiting a well-balanced enthusiasm in all of its branches, and by ability and trustworthi-

* District Engineer, U. S. Geological Survey, Custom House, Boston, Mass.

ness establish himself in the confidence of all with whom he has professional or business relations." This is just as properly the code of the railroad engineer or the sanitary engineer, and it is also equally becoming all engineers "to cultivate patience, courtesy, and a sympathetic personality," as the drainage engineer is advised to do.

In the twenty-eight pages devoted to "Engineering Technique" the author has made brief mention of some of the methods used in making field surveys and in plotting the work in the office. It appears doubtful, however, if the descriptions of methods are complete enough to fully instruct a novice, whereas to an experienced engineer this description of surveying methods would be unnecessary. In describing methods of survey for contour lines, Mr. Elliott treats of two methods: "The transit and stadia method," and "the level and chain method, — the land first to be laid off in 100-ft. squares." One might wonder why the plane table method was not also suggested. In this part of the book various elementary subjects are treated at greater length than their importance warrants, as for instance, the page devoted to "Copying Maps" describes in detail the apparatus used in making blueprints. This topic is immediately followed by a well-written section on "Reports and Estimates," covering slightly less than two pages. "Drainage and How Accomplished," "The Preliminary Survey," "Underdrains and Their Location," "Selection of Drain Tile," and "Construction of Tile Drains" are chapters containing much technical information of real value to the engineer. The chapters on "Flow in Underdrains," "The Run-off from Underdrained Areas," "Size of Tile Drains," and "Flow in Open Channels" are largely theoretical and contain only one reference to the interesting and valuable facts which have been brought out through the work of the drainage engineers of the U. S. Department of Agriculture.

Chapter XIII, "The Run-off from Large Areas," contains several sections of interest. The topics: "Evaporation," "Relation of Soil to Run-off," and the table giving Flood Discharge of Streams should be of value to many engineers, although the table of Flood Discharge gives no references to floods occurring in any years except 1903, 1904 and 1905. The curves

showing relation between size of drainage area and run-off in cubic feet per second per square mile, which were prepared for drainage studies in the upper Mississippi valley and in Illinois, appear similar in form to curves for streams of New England. Several chapters in the latter part of the book deal with construction and problems incident to construction and operation of drainage systems. These chapters contain clear and concise discussions of the relative merits of different methods, with as much description as appears necessary for a full understanding of the subject. Chapters of special interest are: "Reclamation of Tidal Lands," "Drainage of Irrigated Lands," and "Drainage of Home Surroundings." In the chapter last mentioned it is shown that the drainage of farmsteads and village lots may appear insignificant when compared with extensive drainage projects, but that when considered from a sanitary standpoint the drainage of the home surroundings is of great importance, not only in the added beauty of the grounds and the better growth of shrubs and flowers, but also to the health and happiness of the resident.

RECENT ADDITIONS TO THE LIBRARY.

U. S. Government Reports.

Central Electric Light and Power Stations. 1917.

Financial Statistics of States. 1919.

Water Supply Paper No. 436. (Missouri River Basin.)

State Reports.

Massachusetts. Report of Metropolitan Park Commission. 1919.

Massachusetts. Report of Gas and Electric Light Commission. 1919.

Massachusetts. Report of Metropolitan Water and Sewerage Board. 1919.

New York State. Preliminary Report on Sacandaga and Genesee Water Power Development. John R. Freeman. 1908.

Rhode Island. Annual Report of Public Utilities Commission. 1919.

County Reports.

King and Pierce, Wash. Report on Flood Control of White-Stuck and Puyallup Rivers. 1920.

Municipal Reports.

Holyoke, Mass. Annual Report of Board of Water Commissioners. 1919.

Melrose, Mass. Annual Report of Board of Park Commissioners. 1919.

New Bedford, Mass. Report of Sewage Disposal. 1911.

New Bedford, Mass. Annual Reports of Water Board, 1901-11.

New York, N. Y. Report of Commissioner of Bridges. 1901.

New York, N. Y. Report of Commissioner of Bridges. 1904.

New York, N. Y. Report of Bureau of Buildings. 1915.

New York, N. Y. Report of Board of Estimate and Apportionment. 1906-7.

New York, N. Y. Report upon Tunnel under East River. 1894.

New York, N. Y. Report of Board of Water Supply. 1911.

New York, N. Y. Report of Board of Water Supply. 1919.

North Adams, Mass. Annual Report of Officers, 1897, 1898, 1904-7, 1911-12.

Ogdensburg, N. Y. Annual Report of Mayor. 1897-98.

Pittsfield, Mass. Annual Report of City. 1906.

Portland, Me. Annual Report of Water District. 1908-11.

Providence, R. I. Proposed Plan for a Sewerage System. 1884.

Providence, R. I. Annual Report of City Engineer. 1919.

Quincy, Mass. Annual City Report, 1905-6.

Reading, Pa. Annual Report of Water Commissioners. 1894, 1906-7, 1907-8, 1910-11.

Reading, Pa. Annual Report of Bureau of Water. 1918.

Rochester, N. Y. Annual Report of Executive Board. 1891.

- Salem, Mass. Report of Water Supply Board. 1913-15.
 Salt Lake City, Utah. Annual Report of City Officers, 1905, 1906, 1916.
 Somerville, Mass. Annual Report of City Engineer. 1905, 1907.
 Somerville, Mass. Contract and Specifications for Wrought-Iron Reservoir. 1889.
 Somerville, Mass. Contract and Specifications. Pumping Engine and Boiler. 1889.
 Somerville, Mass. Annual Report of City. 1916, 1918.
 Syracuse, N. Y. Report on Extent of First Works for Supplying Water to Syracuse. 1889.
 Taunton, Mass. Report on Water Supply. 1875.
 Taunton, Mass. Report on State Lunatic Asylum. 1878.
 Taunton, Mass. Report of Water Board. 1896-1911.
 Toronto, Ont. Report of Sewage and Garbage Disposal. 1889.
 Toronto, Ont. Report of City Engineer. 1910.
 Toledo, Ohio. Report of Water Works. 1877.
 Troy, N. Y. Annual Report of Public Works. 1900, 1905, 1906, 1907.
 Waltham, Mass. Annual Report of Town Officers. 1875, 1878.
 Waltham, Mass. Contract and Specifications for Section 3 of Sewerage System. 1891.
 Waterbury, Conn. Municipal Register. 1896-98, 1900-5.
 Watertown, Mass. Report on System of Sewerage. 1891.
 Watertown, Mass. Annual Report of Town Officers. 1895.

Miscellaneous.

- Engineering Enquiry. Tomey Thompson. (Gift of H. S. Knowlton.)
 Graphite. Department of Mines, Canada. Hugh S. Spence.
 Power Development of Small Streams. Harris and Rice. (Gift of authors.)

LIBRARY COMMITTEE.

BOSTON SOCIETY OF CIVIL ENGINEERS
FOUNDED 1848

PAPERS AND DISCUSSIONS

This Society is not responsible for any statement made or opinion expressed in its publications

AN ENGINEER'S IMPRESSIONS OF JAPAN.

By DANA M. WOOD,* MEMBER BOSTON SOCIETY OF CIVIL ENGINEERS.

(Presented September 15, 1920.)

SCARCELY more than fifty years ago, Japan was a self-sustaining country with little or no interest in the outside world. Then came a period of years when she was getting acquainted with her neighbors, receiving visitors from all parts of the world in increasing numbers and sending her own young men and women to other countries for educational purposes. Most naturally this has led to the introduction of broadening ideas and the gradual development of business relations.

Formerly Japan was an almost strictly agricultural country. It has been an increasingly difficult problem to feed the nation. Her population is about 57 000 000, which, with a Korean population of about 17 000 000, gives the empire a total of 74 000 000 people. Japan is reputed to be one of the most densely populated countries in the world, having about 450 people per square mile.

With the opening of foreign markets an increasing amount of food and other supplies have been imported. At the same time the industries have been gradually developing, and new trades created, thus diverting some of the labor into new enterprises. Exports, principally silk, have been increasing rapidly and until recently a favorable trade balance maintained. The World

* With Stone & Webster, 147 Milk Street, Boston, Mass.

War found Japan in the position of changing from an almost strictly agricultural country to one with diversified interests in which her industrial development was rapidly becoming predominant. She realized large profits during the war, largely due to greatly inflated prices of the commodities sold in foreign markets.

To illustrate, the total production of silk nearly doubled from 1913 to 1919, while the value of all kinds of silk goods exported increased from about \$122 600 000 to \$409 400 000, or over three times. Total exports were about \$316 000 000 and \$1 050 000 000 for the same years, so that the silk industry represented about 39 per cent. of the total exports in both years.

In 1919 about 95 per cent. of all silk exported was delivered in the United States. During this same year there were sold in the United States goods of all kinds to a value of about \$414 000 000, the silk products representing about 99 per cent. of the total. Japan is also noted for its porcelains, bronzes, toys and works of art.

About 35 per cent. of the total imports to Japan during 1919 was from the United States, and about 37 per cent. of these imports was raw cotton. Cotton mills are rapidly increasing in number, and considerable American-made mill machinery imported.

The foregoing has been mentioned to indicate how rapidly Japan has been changing to a country with considerable industrial development. It also indicates a frequently heard argument in favor of continued friendly relations between the two countries, — that neither country can afford commercially to lose the friendship of the other.

Pressing Engineering Problems. — Such a complete change in the life of a nation cannot be made without introducing many new engineering as well as business problems.

New shipping lines and additional boats to accommodate the increasing trade resulted, during the earlier part of this year, in a congestion at the ports. Yokohama is the most important port, and now has good docking facilities, but they became inadequate for handling the rapid increase in ocean freights. While we were in Japan some vessels were weeks in port, endeavoring

to unload. Lighters were extensively used in addition to the docks, but resulted in higher costs for handling the freight.

More serious still were the shore facilities. So much freight was being handled during the first part of this year that all warehouses were filled, and consignments were piled one upon the other in the dock yards. Customs officials could not keep up with the volume of business. As a secondary contributing factor, because of the gradual curtailment of bank credits to be mentioned later, many consignees left their goods in customs, adding to the congestion. All of this resulted in slow deliveries. One Japanese engineer stated in April that he had, to date, been unable to get machinery landed at Yokohama early in December.

What applies to Yokohama may be said also of the other principal ports, which are probably too few in number, but which must also have additional facilities if the congestion is not to continue.

The railroad situation is another contributing factor to this undesirable condition. They are narrow gage (3 ft. 6 ins.), and with their small and insufficient number of cars cannot properly handle the freight to and from the shipping points. Originally, private capital developed numerous short lines, but the Government has gradually taken over and consolidated the control until now practically all lines are operated by the Imperial Railways Bureau.

Recently it has been proposed to electrify the main lines and those where tunnels are numerous, and to broaden the gage to our standard of 4 ft. 8½ ins. A bill was introduced in the Diet for this purpose, carrying an appropriation of \$50 000 000, and it was proposed that the Government should furnish half the necessary capital, the balance to be raised from private sources. This bill has been withdrawn and the work indefinitely postponed as a result of the recent financial crisis.

Japan has already had some experience with electrified lines, the principal one running between Yokohama and Tokyo, a distance of 18 miles. Some short mountain sections, where there are numerous tunnels, are also electrified.

The trains and city trolley lines are at times badly crowded, and as a result there are three different companies contemplating

subways or elevated lines in Tokyo. Since much of this city is built on filled-in marsh lands, some interesting problems must be met, especially with regard to safeguards against earthquake shocks which are frequent.

Highways are poor for the changing traffic conditions. Originally built for foot and rickshaw travel, with very few horse- and ox-drawn vehicles, the recently increasing numbers of automobiles and auto trucks are tearing these roads to pieces. An American engineer was recently called in consultation and several experimental sections of macadam, etc., laid in Tokyo and Yokohama. It is proposed to connect the important cities with good trunk line roads, gradually extending these inland, besides improving the city streets. Except on the newer city streets built after a conflagration, no sidewalks exist, and it will prove a serious problem to widen for sidewalks and also widen the roadways, and to educate the people in their use when built. At present the people are all over the street, and auto riding is not all joy.

Bridges must be built across wide rivers and over deep gorges in the mountains. Many problems will be met in their construction.

Owing to the great increase in demand for power for industrial expansion and for the possible electrification of the railroads, and because coal is not mined in sufficient quantities or of sufficiently good quality, water-powers are rapidly coming into importance. Because of the large demand, many water-power schemes are being promoted, some obviously uneconomical, others very promising.

Building construction is active, and many new office buildings and hotels are either under construction or being contemplated. In Tokyo the height of buildings is at present limited to 90 ft. because of earthquakes; the highest actually built is 80 ft., and few exceed three or four stories. The principal types are wood frame with plaster finish and structural steel with stone finish. Many of the wealthier people are now desirous of the so-called European home. This is to be regretted, as it usually causes wide departures from typical Japanese architecture which is so attractive and adaptable in many ways. In some cases a

compromise is being made, retaining the Japanese exterior with one wing devoted to foreign-style rooms and furnishings. The introduction of furnace heat, glass windows which are modeled after our own, doors and such like features, will any one of them result in a complete departure from the present Japanese style of architecture and bring up serious problems of design, if the best features of the Japanese house are still to be retained.

Water supplies for nearly all of the largest cities have already received considerable attention, but much remains to be accomplished elsewhere. Where improvements have been made, slow sand filtration with gravity distribution is almost universally used. The rate of filtration for Tokyo is said to be an 8-ft. depth in twenty-four hours. The water runs 500 bacteria per c.c., which is reduced by filtration to about 40 per c.c. Kyoto has the only rapid filtration plant in Japan.

Much trouble is experienced in the distribution mains from breakage during earthquake shocks, which are frequent, especially along the Pacific coast. One solution now being investigated is the use of wrought-iron pipe with flexible lead joints.

Modern sewage disposal systems are not used. The bucket system is used everywhere, and the sewage is used for fertilization of the farms. The introduction of any modern system will include the problem of supplying a substitute fertilizer. Commercial fertilizers are not used to any extent.

Recent Financial Crisis. — As a result of a favorable trade balance for a considerable time, with the rapidly increasing national wealth, prices rose during 1919 and early in 1920 to unheard-of levels. The general prosperity resulted in over-optimism and a rush of development enterprises. Because industrial development had not reached a point where materials could to any large extent be obtained within the empire, large foreign commitments were made.

During the latter part of last January the Government issued orders through the Bank of Japan, the central financial institution, to curtail credits. On top of this, the trade balance for the first time in a long while became unfavorable, imports exceeding exports, and this condition has continued since. A quite recent report indicated that imports had exceeded exports for the

partial year to an amount between 500 and 600 million dollars.

The result has been, first, a gradual retrenchment, then a sudden crash in prices, some bad failures and the closing of many factories during the readjustment period. Late reports indicate a present dull state of business affairs.

Because of the financial crisis, — a near panic, — all new enterprises are temporarily halted. The fundamental conditions remain the same, however, and if Japan is to become an important nation her industries must continue to develop rapidly and many changes made from centuries-old habits.

To complicate any prediction as to how long the depression may be expected to last is the political situation both at home and abroad. At present, Japan may be said to be a militaristic nation with a paternal autocratic form of government. Much unrest and agitation for an enlarged male suffrage with larger control in government affairs exists at home; and her relations abroad toward Korea, China and Russia will have to be settled in some favorable way. Our own Japanese problem in California also offers an unfortunate chance for uneasiness in both nations.

Language. — The language is a serious difficulty encountered by the foreign engineer doing business in Japan. English is taught in all the schools at an early age, but usually by Japanese teachers, so that many can understand written but not spoken English. Along the usual tourist lines of travel English is spoken sufficiently for the foreigner to get along comfortably. Hotel clerks, railroad trainmen, usually one or more clerks in the best stores, speak English passably. Many of the bankers and business men speak it surprisingly well.

On the other hand, the Japanese study and understand only simple and pure English, and do not understand contractions, slang or common idioms. They are apt to make literal translations. Think of their mental confusion when one says, in discussing a problem, "Where do we stand now?" "Won't" and "don't" are very difficult for them to understand, and their use should be carefully avoided.

Negative questions are not used in Japanese, and their use in English is a common source of misunderstanding. For ex-

ample, you may say, "I do not believe we should plan to go to-morrow, do you?" and the invariable answer will be, "Yes." In reality, the literal translation of the corresponding answer in Japanese means, "I agree with you," or "I understand," and this is what is meant by his answer. This is a common source of business misunderstanding until the foreigner learns to avoid using the negative question.

The language is difficult because it is guttural and therefore very hard to pronounce correctly. Yet it is quite essential, if one intends going without an interpreter or to inland points where English is rarely or never heard, to acquire at least enough of it to be able to order meals and accommodations, and to talk on business matters to a limited extent. Otherwise, even with an interpreter, one's progress is very slow in acquiring the information desired. It is quite different from traveling in European countries, where language similarities can be found and the meaning often guessed correctly. The written Japanese is impossible to acquire in a short time, and the spoken has no similarity to English in sound or construction. "O Hayo!", for example, means "Good-morning!" but translated literally is, "Honorable early."

Geography of Japan. — The Japanese Empire includes a main island known as Hondo; Shikoku and Kyushu closely adjacent to the south; Yezo, one half of Saghalien near Siberia and known as Harafuto, and the Kuriles to the north; still further south the Luchu Islands and Formosa; and Korea. The northern half of Saghalien and the Russian port of Nikolaevsk have recently been occupied by the Japanese military forces, and may, like Port Arthur, Vladivostock and the Shantung peninsula in China, be under their authority for some time to come. Altogether, exclusive of the temporarily occupied territory, the empire includes $5\frac{1}{2}$ large islands and about 4 000 small ones, besides Korea, which stretch in a long, thin line for nearly 2 000 miles, from 22 degrees to 51 degrees north latitude and 120 degrees to 156 degrees east longitude. Hondo has a maximum width of 200 miles, with an average of 110, and is about 800 miles long, and has an area of about 86 300 square miles.

The entire empire is subject to earthquakes, but some sections more than others, both as regards severity and frequency of occurrence. The effect upon design should be considered for every major structure built.

Dr. F. Omori, of the Tokyo Imperial University, and an international seismological expert, states that the islands were originally formed by pressure from the direction of Asia. The Japan Sea is relatively shallow with a maximum depth of 3 000 meters. On the Pacific Ocean side there is a sudden deepening to 8 000 meters. It is along this side, south toward Formosa and north to the Aleutian Islands, where the zones of greatest seismological disturbances exist, while the Japan Sea side is subject to only occasional and slighter shocks.

Rivers in Hondo, about one third of which was included in our investigations, are of the mountainous type, quick falling except toward the mouths, and subjected to sudden heavy floods carrying much silt and rolling large bowlders. The river channels shift after every big flood. For these reasons it is necessary to design river structures for conditions met with only in our own most mountainous sections. Rivers seldom exceed a length of 110 miles, and drainage areas of 2 000 square miles.

The climate varies from the torrid to the frigid, and remarkable changes are found in a few hours' travel from the coast into the mountains, or from the south to the north.

Observations of precipitation and other meteorological data are available since 1892 at numerous stations, about 2 000 stations being maintained at the present time. Rainfall records are kept in millimeters, but are otherwise obtained and reported in a manner quite similar to that used by the United States Weather Bureau.

The standard rain gage consists of a cylindrical receiver 20 cm. in diameter, with non-evaporating receiving apparatus and glass collecting bottle. The gage is usually sunk into the ground to such a depth that the top will be 20 cm. above the ground. Often two are installed, one being read at 10 A.M. and the other every hour, or six times daily.

Records indicate a variation of from 35 to 138 ins. in different parts of the empire. Tokyo averages about 60 ins., with a range

of from 45 to 76 ins. Intense storms at Tokyo show a twenty-four-hour total of from 7 to 8 ins.

The run-off records are not very reliable, as they have been obtained for only about two years. During the war such work was stopped, but was resumed about a year and a half ago, these latter records not yet being available. Methods similar to those employed in this country are used, but the men have not yet become skilled either in practice or theory.

Indications are that the average run-off is from 3 to 5 or even more second-feet per square mile. Minimums are high, from 1.25 to 2.50 sec. ft. per square mile. Run-off varies during the year in about the same ratios as in America, high water occurring in the summer months. The range in stage from low to high water is from 18 to 40 ft., with one extreme case noted of 70 ft. This introduces special problems in tailrace design at power plants.

Tokyo, the largest city, has a population of 2 300 000 (some reports give as high as 3 000 000), Osaka has about 1 400 000, while Kyoto, Yokohama, Kobe and Nagoya vary from about 800 000 to 500 000. These are the largest cities in the empire.

Water-Power Development. — Japan has already installed many hydroelectric developments, ranging from 100 to 1 100 ft. head and 5 000 to 50 000 k.w. capacity, at what may be considered the more important installations.

Because of the quick control required at dams, the roller-crest type has been installed in a number of instances and is quite popular with Japanese engineers. Special sand catching designs were seen in use. Overhead gate mechanisms or head gates are universal, and separate generator fly-wheels were frequently observed. These represent the most obvious departures from our practice.

Essentially all power developments are of the low diverting dam type, with long waterways, usually with long tunnels and shorter canal sections, open hillside forebay, and pipe lines to the power house. Storage and pondage are rarely available or used, and only a few plants can be said to be developed with this in view. Natural storage sites and lakes are rarely to be found.

At those possible sites that do exist, the intensive cultivation of the ground offers a serious handicap.

Conclusion. — Because of the broad scope of this article, it has been possible merely to outline some of the many interesting impressions received and observations made while in Japan.

The political and economical situation in the Far East is fully as interesting as the engineering. Along these lines, Mr. Thomas W. Lamont said, in the *Boston Transcript* of September 15, 1920:

"Japan is commercially handicapped by the policy of the so-called military party, whose philosophy of force clashes with the liberal ideas of Japan's manufacturers, great merchants and bankers.

"The business men believe their nation's development should be along lines of peaceful trade and the cultivation of good-will, while the military party, 'which of recent years has been so strong as almost to constitute an actual super-government, still thinks the world is ruled by force rather than by ideas. At the present time this policy, which has resulted in tremendous taxation to maintain the army and navy, will prevent American coöperation on a large scale in developing Japan's industries.' "

MEMOIR OF DECEASED MEMBER.

ROBERT WINTHROP PRATT.*

ROBERT WINTHROP PRATT, consulting, civil and sanitary engineer of Cleveland, Ohio, was born at Brookline, Mass., on December 21, 1876. He was the son of Grace Otis (Kellogg) and Robert Winthrop Pratt, and traced his ancestry to John Alden.

He was graduated from the Boston Latin School in 1894, with high rank, and entered the Massachusetts Institute of Technology the same year, where he completed a civil engineering course in 1898, receiving the degree of bachelor of science.

Mr. Pratt then served as engineering assistant to the Massachusetts State Board of Health, where he had previously been employed during school vacations. Later he was employed as instrumentman on grade-crossing work, in the Engineering Department of the Boston and Albany Railroad. In June, 1899, he returned to the Massachusetts State Board of Health, as assistant engineer, and was engaged in making investigations and preparing reports on existing water supply and sewage works in the state, and also preparing reports on plans for proposed work.

In June, 1903, Mr. Pratt became chief engineer of the Ohio State Board of Health, in which position he was required to investigate and pass upon several hundred plans for proposed water supply and water purification, sewerage, sewage treatment, refuse and garbage works. His recommendations were used as a basis of action by the board of health in acting upon plans. He was also placed in charge of a special investigation, by authority of the legislature, of all existing water-purification and sewage-treatment plants in the state. During this time he served a number of cities in Pennsylvania and also the city of Wyandotte, Mich., on problems connected with water supply and sewerage. He also acted as special hydrographer of the United States Geological Survey and was in charge of the gaging work then being conducted by that department in Ohio.

From July, 1910, to July, 1911, when on leave of absence

* Memoir prepared by George W. Fuller and Morris Knowles.

from the Ohio State Board of Health, he held the position of director of sanitary engineering for the republic of Cuba. He was engaged in making investigations and recommendations for the improvement of sanitary conditions, as well as for plans of water supply and water purification for a number of Cuban cities.

Mr. Pratt was joint author with Prof. L. P. Kinnicutt, of Worcester Polytechnic Institute, and Prof. Charles E. A. Winslow, then of the Massachusetts Institute of Technology, in the comprehensive and favorably received text and reference book entitled "Sewage Disposal."

From 1911 to the time of his death he maintained an office in Cleveland in the practice of civil engineering, largely upon municipal work. A large portion of the time was spent on work for the city of Cleveland, in the design of the filtration works, and in making investigations for the treatment of the city sewage. During the last ten years he was retained by many city, county, or state governments in consulting, designing and supervising work. His work covered principally Ohio, Pennsylvania, Michigan and Ontario.

During the World War he was employed by the United States War Department as supervising engineer on the construction of Camp Sherman, Chillicothe, Ohio (capacity 40 000 men), one of the original sixteen cantonments, planning and directing the construction of water supply, drainage, sewerage, sewage treatment and roads. He was also engaged by the United States Shipping Board to supervise utilities necessary for industrial housing developments in Wyandotte, Mich., and Lorain, Ohio, and similarly served the United States Department of Labor, on its housing project at Alliance, Ohio.

The most important work in Michigan was an investigation of the Detroit water supply, with reference to filtration and other improvements, including the supervision of the operation of a demonstration filtration plant. At the time of his death he was connected with several projects of various kinds.

Mr. Pratt was a member of a number of professional societies, as follows: American Society of Civil Engineers, New England Water Works Association, Boston Society of Civil Engineers,

Engineers Society of Pennsylvania, Cleveland Engineering Society.

Probably no better tribute can be written than that prepared by his classmate and life-long friend and associate, Prof. C.-E. A. Winslow, of Yale University, who in writing for the *Technology Review* says in part:

"To those who knew the man and knew his work, these summary statements of positions filled and work accomplished are significant of a unique and fruitful public service. The science of municipal engineering at many points bears the impress of Winthrop Pratt's constructive vision, for he never feared to do the new things which his clear and alert mind felt to be sound and practical. The immediate and tangible results of his labors are seen in hundreds of municipalities in this country and in Cuba, and thousands of men and women have been safeguarded from water-borne diseases by the sanitary works which he made possible.

". . . Behind the work and in the work is the man; and it is of the man, Winthrop Pratt, that his classmates are thinking with a sense of keen and vital loss. His big frame and his slow, kindly smile were the outer signs of a nature that was at once strong and gentle. He was a tireless and enthusiastic worker, a clear and sound thinker, a born business man with a Yankee love of bargaining. Yet he was always patient and fair-minded and considerate of others. His contracts were secured because his integrity inspired confidence. His subordinates were devoted because his character won their complete loyalty. Winthrop Pratt's life was a successful life. His friends, while they mourn a deep and personal loss, can feel proud of a career which, even though cut short in its prime, is builded imperishably into the progress of engineering and the development of our country, and of a life which leaves behind it the memory of a strong and upright and lovable man."

Mr. Pratt had a pleasing personality which gained friends for him wherever he went. He had a broad outlook, and radiated confidence and good-will. On June 1, 1903, he was married to Elizabeth Southwick, of New York City, who survives him, with two sons and two daughters. After a short illness of pneumonia, he passed away at his home in Cleveland on the morning of February 2, 1920. The engineering profession loses an earnest student and his associates a cordial and sincere friend.

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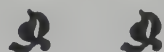
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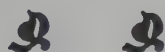
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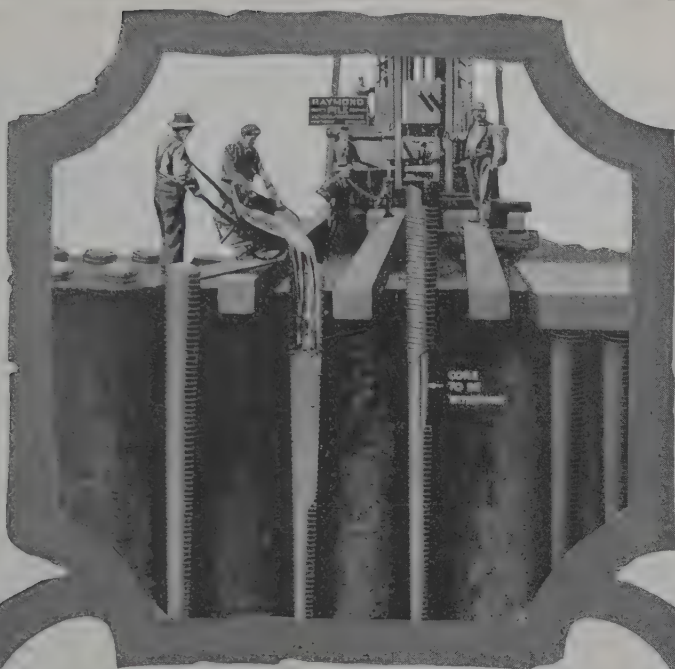
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